Space Weather Technical Forecast

Issued on Friday, 12 July 2024 at 01:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares expected. Chance of G1 Minor Storms mainly day 3 (13 Jul).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with two M-class flares observed, the largest of which peaked at M1.4 at 10/1204 UTC from AR3738 in the south centre disc. This is largest and most complex of the nine sunspot regions on the disc, currently with a Fki/beta-gamma classification, and has seen ongoing slow growth with further small spots emerging within it. The remaining regions are all smaller and simpler and mostly stable or decaying. However, AR3743 has recently developed slightly to become Dai/beta.

No Earth-directed CMEs occurred, however a large asymmetric halo was observed in coronagraph imagery from off the far-side.

Solar Wind / Geomagnetic Activity: Slow wind conditions were observed by ACE, continuing at background levels around 350-380km/s. Density remained below average. Interplanetary Magnetic Field, Bt, was weak, 6nT or less. The north-south component, Bz, varied weakly between +5/-5nT. Phi angle was mostly negative (toward the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was predominantly at background levels. The 24-hour fluence was below Active, with 2.29e6 integrated pfu observed at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected with further M-class flares likely, with AR3738 the probable source.

Solar Wind /Geomagnetic Activity: There are no Earth-directed CMEs. Slow wind conditions at first, with a chance of slight enhancement from any fast wind interaction from the small southwestern coronal hole CH53 today (12 Jul). A more notable enhancement is then likely tomorrow, peaking later in the day or early day 3 (Jul 13-14), due to the onset of the fast winds of CH52. Through day 4 (15th) the solar wind is expected to decline to background levels. Initially Quiet geomagnetic conditions are expected to increase to become Unsettled at times today (12th) and then Active to G1/Minor geomagnetic storm later tomorrow into day 3 (14th). Through day 4 (15th) Quiet to Unsettled conditions are expected to return.

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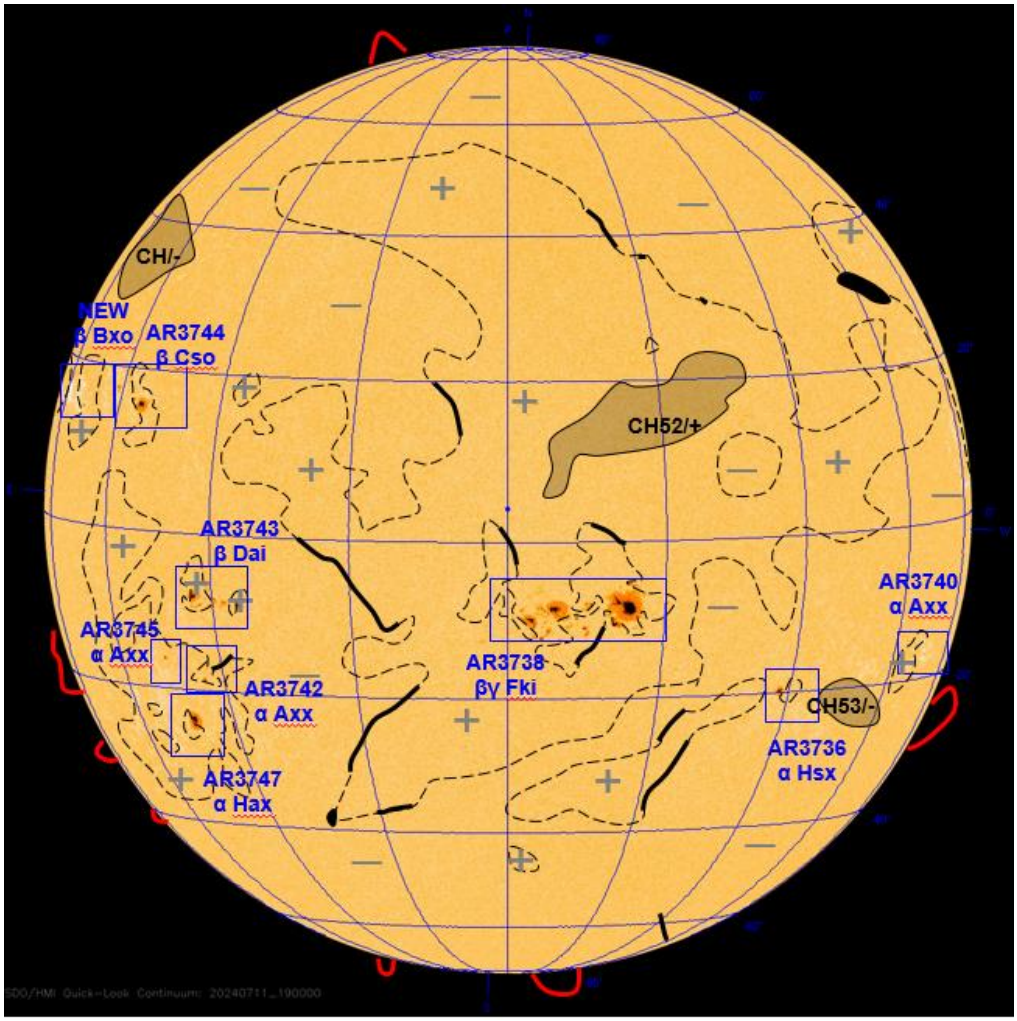
Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background, but with a chance of rising in response to any notable flares from AR3738, with a slight chance of approaching the S1 Minor Solar Radiation Storm threshold. High energy electron flux is expected to remain mostly at background, but may respond to any fast wind enhancement, increasing to Moderate with a slight chance of reaching High on days 3 and 4 (14 and 15 Jul). The associated 24 hour fluence is expected to remain below the Active level, but with a slightly increasing trend later in the period.

Figure 1. Solar Analysis Valid 11/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

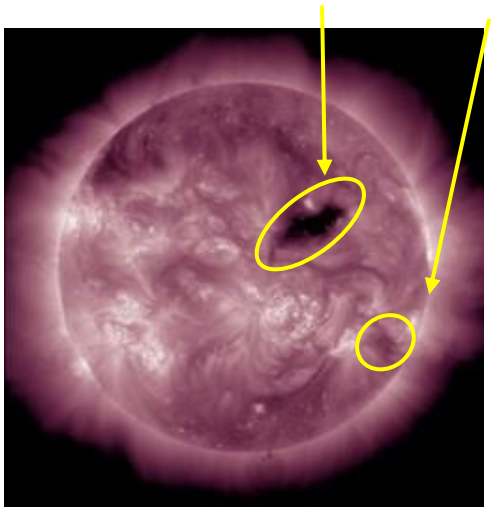
Currently there are no Earth-directed CMEs expected.

Current slow wind conditions may become slightly enhanced today (12 Jul) due to the onset of the fast wind from CH53 located in the southwest disc. The extent of any enhancement is low confidence, due to the small size and weak appearance of CH53, therefore any connection is expected to be weak. MOSWOC Enlil is over-estimating the extent of this feature, therefore is currently providing poor guidance. Slightly elevated solar winds are possible, perhaps increasing geomagnetic activity from initially Quiet to become Unsettled at times.

Any enhancement is likely to ease into day 2 (13 Jul), before the onset of the next fast wind, from north-centre disc CH52/+. This is a broad positive hole in the northwest quadrant, and fast wind onset is most likely to occur tomorrow, but likely peaking later in the day or early day 3 (13-14 Jul). This low confidence, as while the coronal hole did feature on the previous rotation, its appearance and location has changed, and Enlil is also unable to provide good guidance due to the over-estimation of the southwestern coronal hole. However, elevated winds are likely by the end of day 2 into day 3 (13-14 Jul), increasing the activity to Active to G1/Minor Geomagnetic Storms levels. Through day 4 (15th) solar wind speeds are expected to gradually decline, probably back to background levels, as geomagnetic activity also declines.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	10	30	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SDO/AIA 211 image clearing showing CH52, with CH53 barely visible.



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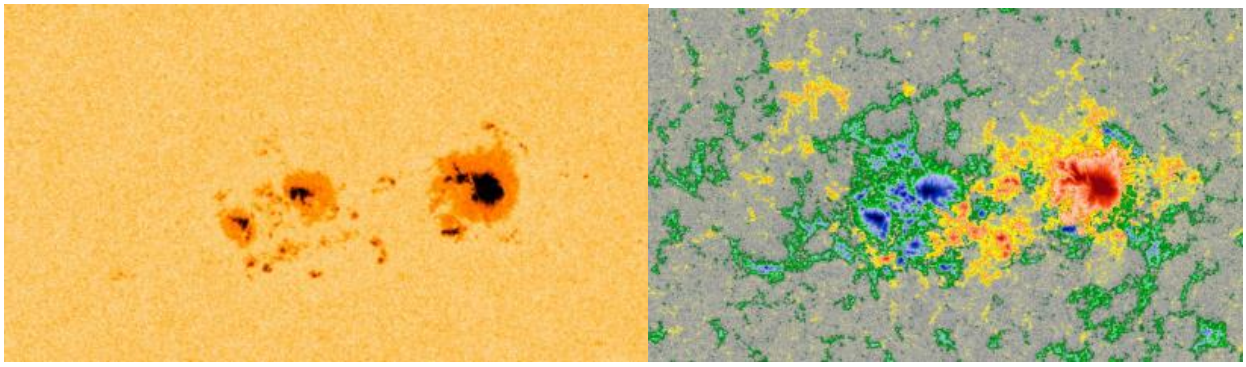
Radio Blackouts - X-Ray Flares:

There are nine regions on the disc, as previous region AR3746 has now faded. AR3738 in the south centre disc remains the most notable feature. Despite being a reasonable size, the region currently has only limited complexity, with some mixing of polarities resulting in a beta-gamma configuration. Its classification has recently changed to become Dai/beta-gamma due to the merging of small intermediate spots with the main spot within the region, resulting in asymmetric penumbra. The other regions on the disc remain simple, either stable or with only minor recent changes.
Further M-class flares are likely, with a slight chance of an isolated X-class flare, mainly from AR3738.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	75	70	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: Latest SDO/HMI images (left intensitygram and right magnetogram) of AR3738.



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at background levels. It is most likely to remain at background levels, but with a slight chance of exceeding the S1/Minor radiation storm threshold should any larger flares occur, mainly from AR3738. As this region rotates across the southwest quadrant, the probability of reaching S1 increases slightly.

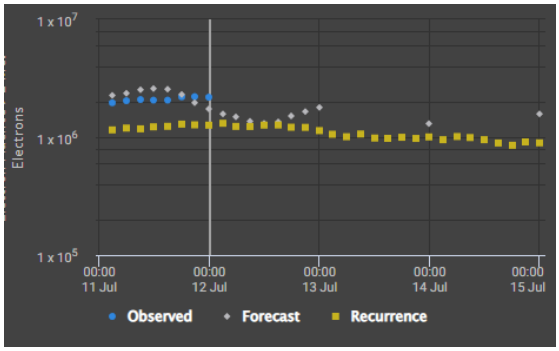
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	15	15	15
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux observed at GOES16 has been at background is expected to persist at this level, until at least day 4 (15 Jul). Any enhancement from the fast wind of CH52 from day 2 (13 Jul) may then allow for an increase to Moderate, perhaps briefly High flux.
The associated electron fluence is forecast to remain below the Active threshold, but with the potential for a rising trend from day 3 (14 Jul). MOSWOC REFM is currently giving good guidance, and is expected to remain so until the onset of any fast winds.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Met Office REFM model.



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